

REMARKS**I. Status of the Claims**

Claims 2, 17-74, 76-108, 110 and 112-113 are currently pending. Claims 1, 3-16 and 75 were previously cancelled. Claim 109 is cancelled by this amendment.

Due to a typographical error in the claim numbering presented in a Response dated January 13, 2009, number 111 in the listing of claims was omitted. Thus, in this Response, number 111 has been added to the claim listing, as a place holder, and labeled as “cancelled.”

Applicants have resubmitted the amendments to claims 2, 17, 18 and 27 to comply with 37 CFR 1.173(b). These resubmitted amendments reflect the change in dependencies of the claims occasioned by the cancellation of claim 1 in the January 13, 2009 Response.

Claims 79-82, 86-89 and 92 have been amended to recite “for quantitative measurement” in the preamble (as opposed to “for measurement”). Claims 30, 47, 59, 86-89, 92, 95 and 97 have been amended to recite “means detects changes” (as opposed to “means capable of detecting”) and “the sensing electrode reacting,” (as opposed to “the sensing electrode being capable of reacting”). These amendments place these recitations in the same condition as originally recited in claims 30, 47 and 59.

Claims 79-82, 86-89, 92, 95 and 97 have been amended to incorporate the recitation of now-cancelled claim 109. Support for this amendment can be found at least at col. 11, lines 30-34. Claims 110 and 112 have been correspondingly amended to change their dependency from now-cancelled claim 109 to claim 82.

In the Office Action, the Examiner:

- rejected claims 2, 17-74 and 76-113 under 35 USC 251 as being broadened in a reissue application filed outside the two year statutory period;
- objected to the proposed amendments to claims 2, 17, 18, 27, 30, 47 and 59 presented in Applicant’s January 13, 2009 Response for failing to comply with 37 CFR 1.173(b);
- indicated that the Reissue Declaration submitted September 22, 2008, was not in compliance with 37 CFR 1.67(a);

- asserted that claim 95 and 96 are rejected on the grounds of *res judicata*;
- rejected claims 79, 81, 86, 88 and 97 under 35 USC 103(a) as being unpatentable over Dempsey et al. (US 4,277,984) in view of Nagata et al. (US 4,913,792) and any of Vanderborgh et al. (US 4,804,592), Uchida et al. (US 5,474,857) and/or Grot et al. (US 5,330,860);
- rejected claims 79-101, 103-106 and 108-113 under 35 USC 103(a) as being unpatentable over Tomantschger et al. (US 5,173,166) in view of Dempsey and any of Vanderborgh, Uchida and/or Grot;
- rejected claims 80, 82, 84, 87, 89, 91, 92, 95, 96, 98-101, 103, 104 and 108-113 under 35 USC 103(a) as being unpatentable over Dempsey in view of any of Vanderborgh, Uchida and/or Grot;
- rejected claims 83, 85, 90, 93 and 94 under 35 USC 103(a) as being unpatentable over Dempsey in view of any of Vanderborgh, Uchida and/or Grot and further in view of Nagata;
- rejected claim 102 under 35 USC 103(a) as being unpatentable over Dempsey in view of any of Vanderborgh, Uchida and/or Grot and further in view of Tomantschger (US 5,302,274);
- rejected claim 102 under 35 USC 103(a) as being unpatentable over Tomantschger '166 in view of any of Vanderborgh, Uchida and/or Grot and further in view of Tomantschger '274;
- rejected claims 105 and 106 under 35 USC 103(a) as being unpatentable over Dempsey in view of any of Vanderborgh, Uchida and/or Grot and further in view of La Conti (US 4,820,386);
- rejected claim 107 under 35 USC 103(a) as being unpatentable over Dempsey in view of any of Vanderborgh, Uchida and/or Grot and further in view of Razaq (US 5,322,602); and
- rejected claim 107 under 35 USC 103(a) as being unpatentable over Tomantschger '166 in view of Dempsey and any of Vanderborgh, Uchida and/or Grot and further in view of Razaq.

II. Reissue Application

The Examiner rejected claims 2, 17-74 and 76-113 under 35 USC 251 as being broadened in a reissue application filed outside the two year statutory period. Applicants respectfully disagree. However, in order to further the prosecution of the present application, Applicants have amended the claims, as noted above, to obviate this rejection.

The Examiner objected to the proposed amendments to claims 2, 17, 18, 27, 30, 47 and 59 presented in Applicant's January 13, 2009 response for failing to comply with 37 CFR 1.173(b). Applicants believe that the amendments to these claims now comport with 37 CFR 1.173(b).

III. Declaration

Applicants resubmit herewith the Reissue Declaration in compliance with 37 CFR 1.67(a). This resubmitted Declaration correctly states that the "original patent is wholly or partly inoperative or invalid because patentee claimed more than they had the right to claim." This resubmitted Declaration is consistent with this reissue not being a broadening reissue.

IV. Res Judicata

In the Patent Office, the doctrine of *res judicata* is to be invoked rarely and only when the same claims (or patentably indistinguishable claims) and the same evidence (regarding the patentability or the unpatentability of the claims) is applied to these claims in the same manner as was previously presented to the Board. In this instance, the evidence and at least some of the claims are not the same as was previously presented to the Board.

The Examiner is required to substantively examine the claims and grant patents that comply with the patent statute. This is so, whether or not the application has previously been considered by the Board. The Board has stated, "the policy and purpose of the patent laws preclude the applicability of any doctrine akin to the judicially-developed doctrine of "res judicata" to bar the granting of patents on inventions that comply with the statute," (*Ex parte Conte*, BPAI No. 2000-2033, decided September 2001, citing to *In re Craig*, 411

F.2d 1333, 56 C.C.P.A. 1438 (1969)). The courts have stated, “*res judicata* does not have its usual impact when considering ex parte patent appeals; the public interest in granting valid patents outweighs the public interest underlying collateral estoppel and *res judicata*, particularly where the issue presented is not substantially identical to that previously decided.” (*In re Oelrich*, 666 F.2d 578 (Fed. Cir. 1981), fn 2 (citing to *In re Russell*, 58 CCPA 1081, 1083, 439 F.2d 1228, 1230, 169 USPQ 426, 428 (1971); *In re Craig*, 56 CCPA 1438, 1441-42, 411 F.2d 1333, 1335-36, 162 USPQ 157, 159 (1969).) In other words, if the claims being prosecuted comply with the patent statute, they should be granted.

Additionally, *res judicata* does not automatically apply just because there is an earlier decision by the Board of Appeals. In fact, the MPEP recognizes that the invocation of *res judicata* by the Patent Office has been materially restricted by the courts. (MPEP 706.03(w).) Referring to *In re Craig*, 162 USPQ 157 (CCPA 1969), cited in MPEP 706.03(w), the Court found that the Board of Appeals had improperly sustained the rejection of the claims under the doctrine of *res judicata* (based on an earlier Board decision for the parent application), even though the Board found the claims to be otherwise patentable. The Court reversed the Board’s holding, stating that “claims should not be refused merely because on a previous occasion [i.e., the earlier Board decision] the same or similar claims have been refused on grounds no longer deemed to be valid.” *Craig* at 159. In other words, the doctrine of *res judicata* is not binding on the Patent Office.

The *Craig* Court explained that the doctrine of *res judicata*, in the context of patent prosecution, must be balanced against the mandate of the Patent Office to grant patents to inventions that are patentable under the substantive provisions of the patent statute:

“While *res judicata* has its proper place in the law as a reflection of a policy invoked to settle disputes and put an end to litigation, the prosecution of patent applications is not exactly either a dispute or litigation in the usual sense of these terms. There are additional public policy considerations which have a bearing here, namely, furtherance of the policy inherent in the patent laws to grant patents when the Patent Office finds that *patentable* inventions have been disclosed and properly claimed so that such inventions are made public through the grant. The granting of such patents is also in the public interest Society stands to

lose ... when a patent is refused on an invention which is patentable under the statute.” *Craig* at 159.

Further, in *In re Kaghan*, 156 USPQ 130 (CCPA 1967), the Court found that the Patent Office was actually estopped from rejecting claims solely on the theory of *res judicata*. “A holding of *res judicata* without reliance on any other ground of rejection is not an examination on the merits of the application and so may not be used [following an adverse Board of Appeals decision].” *In re Craig* at 160, citing to *In re Kaghan*. This express admonition is in keeping with the guidance in MPEP 706.03(w), that “when making a rejection on *res judicata*, action should ordinarily be made also on the basis of prior art, especially in continuing applications.” In other words, the MPEP directs the Examiner to determine whether the claims are substantively patentable, and if patentable, allowance of those claims should not be refused merely because on a previous occasion the same or similar claims were refused on grounds no longer deemed to be valid.

Even further, application of the doctrine of *res judicata* is especially improper, as in this instance, where a new record (i.e., new or amended claims and/or new evidence) is before the Patent Office. First, in this reissue application, Applicants present claims (claims 79-94 and 97-113) that were not before the Board in the reexamination appeal. Second, Applicants have presented new evidence (i.e., see below, at least Surampudi, Onishi, and the Sigma-Aldrich Material Safety Data Sheet for Nafion 117, if not also, Nolan and Neidrach, etc.) in support of the patentability of the claims. Third, the Examiner has even presented new evidence (at least, Nagata (US 4,913,792) and Tomantschger (US 5,173,166) to support his assertions of unpatentability. Thus, as the record now before the Patent Office is not the same record that was before the Board when it issued its earlier decision, the doctrine of *res judicata* does not apply.

The predecessor court to the Federal Circuit has held that claims should be examined when a new record (either amended claims and/or new evidence) present a new issue from that previously addressed. See MPEP 706.03(w); *In re Herr*, 377 F.2d 610, 153 USPQ 548 (CCPA 1967) (claims should have been examined even though claims were identical with claims previously held unpatentable on appeal in the parent application; new evidence submitted); and *In re Russell*, 439 F.2d 1228, 169 USPQ 426 (CCPA 1971) (claims should have been examined even though claims were similar to claims as

previously appealed; new Rule 132 affidavits submitted). More recently, in *Ex Parte Gharib* (BPAI No. 2007-0113, October 2007), the Board held that the submission of new evidence, i.e., evidence that was not before the panel in reaching their earlier decision, and the difference in the scope of the claims, presented the Board with a different record than in the earlier appeal. According to the Board, this new record required it to consider and weigh anew the totality of the evidence – the doctrine of *res judicata* did not apply. In *Gharib*, the “new evidence” was an article that predated the filing of the original application. In other words, the “new evidence” was evidence that was newly presented in the prosecution—it was not evidence that was unavailable at the time of the earlier decision.

In another fairly recent decision, *Ex Parte Rexnord Industries, LLC* (BPAI No. 2007-3920, decided September 2007), the Board held that it was improper for an examiner to invoke *res judicata* without careful consideration of the basis for his reliance on the doctrine of *res judicata*:

“Preclusions, including *res judicata*, are powerful and necessary procedural tools, but they are not magic bullets. Proving a preclusion generally requires careful construction of a supporting case. The present appeal illustrates some of the many ways in which a “*res judicata*” theory can go awry.⁸ Since the *res judicata* theory has not been adequately developed in the record before us, we do not give it any weight.”

Footnote 8 of the *Rexnord* Board’s decision states, “There is an implication of serious prosecution misconduct in the *res judicata* argument. ...” Although the link is not explicit, Applicants believe that the Board’s footnote 8 was referring to this statement found in the *Rexnord* Appellant’s Reply Brief, dated January 30, 2007, p. 4:

“Prior to the Examiner’s Answer, the Appellant’s arguments traversing this rejection were ignored on the basis of *res judicata*. As discussed below, the Examiner continues to erroneously rely on *res judicata* as support for the double patenting rejection and dismiss Appellant’s reasoned analysis supporting allowance of claim 3.”

In other words, an examiner cannot summarily and conclusorily invoke *res judicata* to thereby refuse to consider Applicants’ substantive analyses as to the patentability of the claims.

Applicants respectfully submit that the new record in the present application presents a new issue that entitles Applicants to the substantive examination of all aspects

of the claims. Applicants further respectfully submit that whether or not the Examiner was “affirmed” in the Reexamination Decision (dated May 23, 2007) as to any portion of the Examiner’s arguments (i.e., the combination of Dempsey with any of Uchida, Vanderborgh or Grot), it is improper for the Examiner to summarily rely on utilizing these references in the same manner, especially given the new record (for example, the evidence presented by the submission of Surampudi) presented herein by the Applicants with respect to this very combination.

Claims 95 and 96

The Examiner has noted that claim 95 and 96 are identical to claims 79 and 80 presented in Reexamination 90/006,208. Because the rejections of claims 79 and 80 were affirmed by the Board of Appeals in a Decision of May 23, 2007, the Examiner has asserted that claim 95 and 96 are rejected on the grounds of *res judicata* and that Applicants are no longer entitled to further “adjudication” of the issues concerning these claims. Applicants respectfully disagree.

With respect to claims 95 and 96, Applicants present new evidence than that which was before the Board in the earlier decision. This alone renders the doctrine of *res judicata* inapplicable and mandates that the Examiner substantively examine these claims. Further, although the Examiner has maintained the same rejection against these claims that was considered by the Board (i.e., reexamination claims 79 and 80 were rejected as being unpatentable over Dempsey in view of Grot and/or Uchida) (see OA, items 32 and 37), the Examiner has also applied new rejections against these claim (i.e., claims 95 and 96 are rejected as being unpatentable over Dempsey in view of Vanderborgh (see OA, items 32 and 37) and are rejected as being unpatentable over Tomantschger in view of Dempsey and any of Vanderborgh, Uchida and/or Grot) (see OA, item 15). These new rejections further render the doctrine of *res judicata* inapplicable and mandate that the Examiner substantively examine all aspects of these claims. In short, the current prosecution of claims 95 and 96 presents a new record, and this new record prohibits the application of *res judicata*.

Applicants supply courtesy copies of *In re Craig*, *Ex Parte Gharib*, *Ex Parte Rexnord*, and the above-cited to Reply Brief of *Ex Parte Rexnord* herewith.

V. Response to Rejections in the Office Action dated April 3, 2009

a. Nafion[®]

In the Response dated January 13, 2009 (pages 33-34), Applicants indicated that Surampudi (US 5,599,638) teaches that Nafion[®] is a “non-hydrophobic binder”—a binder that when added to hydrophobic electrodes, i.e., electrodes having poor wetting properties, converts the electrodes to non-hydrophobic electrodes, i.e., electrodes having good wetting properties. In the present Office Action, at least in part relying on the disclosure of Razaq (US 5,322,602), the Examiner has indicated that Nafion[®] is “a well-known hydrophobic polymer.” Applicants disagree.

Nafion[®] is a co-polymer of tetrafluoroethylene and perfluorovinylether sulfonic acid (see, e.g., Surampudi, col. 3, lines 60-64). Nafion[®] has a hydrophobic backbone (Teflon) with sulfonic acid (SO₃H) side groups. The sulfonic acid side groups are hydrophilic (see Onishi L. et al., “Water-Nafion Equilibria. Absence of Schroeder’s Paradox,” (2007) The J. of Phys. Chemistry, B 2007;111(34):10166-73 (Abstract supplied) [<http://www.electrochem.org/meetings/scheduler/abstracts/212/0190.pdf>]). Surampudi refers to Nafion[®] as a “hydrophilic proton-conducting polymer (see col. 12, lines 60-63). Applicants further provide herein a copy of a “Material Safety Data Sheet for Nafion[®] 117” supplied by Sigma-Aldrich. At page 3, this data sheet discloses that Nafion[®] is hygroscopic, i.e. capable of easily absorbing moisture. Thus, it is clear that, in at least some aspects, the hydrophilic nature of Nafion’s sulfonic acid side groups impart hydrophilic or hygroscopic properties to Nafion[®] as a whole. And, in fact, Razaq (cited by the Examiner) appears to disclose that Nafion may have both hydrophobic aspects (see col. 3, lines 48-51) and hygroscopic aspects (see col. 7, lines 54-59).

Importantly however, Surampudi goes beyond merely teaching that Nafion[®] has hydrophilic side groups and hydrophilic properties. Surampudi teaches that gas-diffusion type electrodes, which have poor fuel wetting properties, can be modified for use in liquid feed cells by including substances that improve their wetting properties, e.g., Nafion[®] (col.

4, lines 10-21). Surampudi discloses that the addition of Nafion[®] to an electrode allows the liquid surrounding the electrode to flow into or wet the pores, thus creating a liquid-feed type electrode. In other words, Surampudi teaches that electrodes having poor wetting properties (*i.e.*, hydrophobic electrodes) can be converted to electrodes having good wetting properties (*i.e.*, non-hydrophobic electrodes) by the addition of Nafion[®]. It is in this context that Applicants referred to Nafion[®] as a “non-hydrophobic binder,” *i.e.*, when added to an electrode, Nafion[®] allows water to flow into and flood the pores of the electrode. A flooded electrode cannot be used as a gas-diffusion type electrode—in other words, a flooded electrode cannot be used to react with (or sense) gases.

b. The Cited Prior Art

As noted in Applicants’ response dated January 13, 2009, upon further consideration of Dempsey in combination with any of Uchida, Vanderborgh or Grot, Applicants have become aware of the following technical conclusions:

Dempsey

Dempsey discloses flooding one side of a solid polymer electrolyte membrane with distilled water. Specifically, a water channel 7, connected to reservoir 1 via hydrated ports 5 and 6, is positioned over an ionically conductive, hydrated SPE bridge 8 formed on the upper surface of membrane 9. (See Fig. 1; col. 4, lines 30-46.) Further, Dempsey expressly discloses that “the surface of the counter electrode and the membrane area around the electrode is flooded.” (Col. 4, lines 46-49.)

Dempsey’s principle of operation relies on flooding one side of the membrane with distilled liquid water. Dempsey discloses that this flooding of the membrane with distilled water provides “self-humidification,” *i.e.*, transport of water in the vapor phase across the membrane. (Col. 7, lines 50-54, referring to Nolan et al. (US 4,171,253) which discloses, at col. 3, lines 22-26, that “this self-humidifying arrangement is possible in SPE-type gas sensor by maintaining the side of the SPE membrane away from the gas side, *i.e.*, away from the side containing the sensing electrode flooded with distilled water.”) Dempsey further discloses that by eliminating the possibility that the membrane will dry out and by providing an ionically conductive, hydrated SPE bridge, the output current from the device

is improved. (Col. 3, line 64 to col. 4, line 10.) Thus, Dempsey teaches that flooding one side of the membrane with distilled liquid water is important for its principle of operation.

With respect to the electrodes, Dempsey discloses that the electrodes are each “a bonded mass of particles of a platinum-5% iridium alloy and *hydrophobic* particles such as polytetrafluoroethylene.” (Col. 5, lines 29-33; see also, col. 7, lines 25-31; col. 7, line 65 to col. 8, line 4; col. 8, lines 27-29. Emphasis added.) Dempsey further discloses that “the nature and characteristics of an electrode, comprising a mixture of particles of a gas absorbing noble metal bonded with particles of *hydrophobic* material as well as the process for doing so, are described in detail in U.S. Pat. No. 3,432,355 [“Niedrach”]” (Col. 8, lines 31-44. Emphasis added.) Niedrach, in turn, discloses that the electrodes are purposely made *hydrophobic* to prevent flooding/drowning¹ of the electrode when in contact with water:

The electrodes comprise gas absorbing metal particles bonded together into a cohesive mass with polytetrafluoroethylene and having a coating of polytetrafluoroethylene bonded to the electrode surface in contact with the gas phase. These novel electrode structures, when used in combination with the aqueous electrolyte ... do not require special fabrication or additional precautions to prevent the electrolyte from flooding the surface of the electrode in contact with the gas phase, and thereby “drowning” the electrode which would deleteriously affect the performance of the fuel cell reaction.” (Col. 1, lines 19-30.)

¹ “Flooding” refers to the penetration of electrolyte into hydrophobic regions of the catalyst layer which should contain only gas. This misplaced liquid hinders and may totally obstruct the supply of reactant gas to local regions of the catalyst. As a result there is an increase in electrode polarization as the non-flooded regions of the electrode are forced to carry more current. The process is self-propagating and will eventually lead to cell failure. In fuel cells having an acid electrolyte the flooding phenomenon is most prevalent at the cathode i.e., at the water-producing electrode. (See WO/1993/003505) High Current Acid Fuel Cell Electrodes.)

See also, EP0046086: “Early in the development of electrodes for fuel cells it was realised that porous, hydrophobic electrodes were desirable especially for use as a hydrogen anode in order to achieve proper control of electrode wetting and to prevent flooding thereof by the electrolyte so that both the reaction gases and the electrolyte had satisfactory access to the electro-catalyst in the electrode.”

Thus, Dempsey discloses (via its citation to Niedrach and its repeated express disclosure that the electrode binder is hydrophobic) that its electrodes are impervious to the water such that flooding/drowning of the electrode does not occur.

In sum, Dempsey teaches that the counter electrode must be surrounded with distilled liquid water in order to keep the membrane and the ionically-conducting bridge on the membrane, hydrated. Dempsey further teaches the necessity that the electrode be hydrophobic so that drowning of the electrode in the aqueous environment does not occur.²

Uchida, Grot and Vanderborgh

The Examiner has cited to Uchida, Grot and Vanderborgh because each of these references teach, in the context of fuel cells and/or electrolytic cells, the addition of Nafion[®] to an electrode composition.

However, a person of ordinary skill in the art at the time of the invention would have known that the addition of Nafion[®] to an electrode composition would make the electrode non-hydrophobic. For example, US 5,599,638 to Surampudi et al. (filed October 12, 1993, and thus indicative of the knowledge of a person of ordinary skill in the art at the time of the invention) discloses that two major categories of electrodes exist: gas-diffusion type electrodes and liquid-feed type electrodes (col. 2, lines 35-48). Surampudi discloses that electrodes formed of carbon-supported alloy [catalyst] powder and a Teflon[®] binder yield a gas diffusion electrode (col. 2, lines 25-27). According to Surampudi, gas-diffusion type electrodes, which have poor fuel wetting properties, can be modified for use in liquid feed cells by including substances that improve their wetting properties, *e.g.*, Nafion[®] (col. 4, lines 10-21). Surampudi discloses that the addition of Nafion[®] to an electrode allows the liquid surrounding the electrode to flow into or wet the pores, thus creating a liquid-feed type electrode. In other words, Surampudi teaches that electrodes having poor wetting properties (*i.e.*, hydrophobic electrodes) can be converted to electrodes having good wetting properties (*i.e.*, non-hydrophobic electrodes) by the addition of Nafion[®].

² Further, with respect to the Examiner's assertion that Dempsey recognizes that electrodes set forth in the fuel cell prior art would find utility in the sensor of Dempsey (citing to col. 8, lines 30-63, as justification for citing to Uchida, Vanderborgh or Grot), Applicants submit that this recognition by Dempsey of fuel cell prior art electrodes is limited to **hydrophobic** electrodes, such as those taught by Niedrach.

Even further, as would be expected, Surampudi discloses that the amount of Nafion affects the properties of the electrodes. “Electrode compositions with additive in excess of 10% [of the weight of the electrocatalyst] may result in an increased internal resistance of the fuel cell and poor bonding with the solid polymer electrolyte membrane. Compositions with less than 2% of the additive do not typically result in improved electrode performance.” In fact, Surampudi teaches that the desired amount of additive is in the range of 2-10% of the weight of the electrocatalyst.

Thus, Surampudi teaches that Uchida, Grot and Vanderborgh, by disclosing the addition of Nafion[®] to the electrode compositions, all disclose liquid-fuel type electrodes of varying degrees, i.e., electrodes that will allow water to penetrate their pores.³

Uchida is Not Relevant

Uchida fails to disclose electrodes having the claimed composition, i.e., a proton-electron mixed conductive material having 10-50 wt % of a proton conductor material and 50-90 wt % of a first and a second electrical conductor material.

Example 1 of Uchida discloses that 1g of Nafion[®] polymer was added to 60g of n-butyl acetate to form a colloidal dispersion. Then 50g of Pt-C (having 10-25% platinum catalyst) were added to this colloidal dispersion. The resulting paste was coated on carbon paper. Thus, the disclosed electrode of example 1 has 2.0 wt% proton conductor material (1g Nafion[®] / (1g Nafion[®] + 50g Pt-C)) and 98 wt% electrical conductor material (50g Pt-C / (1g Nafion[®] + 50g Pt-C)).

Examples 2-6 maintain the same solids ratios, merely swapping out the organic solvents.

Example 7 adds an additional 25g of carbon powder (having 25-70 wt% PTFE) to the colloidal dispersion. Thus, the disclosed electrode of example 7 has 1.3 wt% proton conductor material (1g Nafion[®] / (1g Nafion[®] + 50g Pt-C + 25g C/PTFE)) and 75.7 wt% to

³ A liquid-fuel type electrode can be used in a non-liquid environment and operated as a gas-diffusion electrode. However, if a liquid-fuel type electrode is used in a liquid environment, it cannot then operate as a gas-diffusion electrode, as its pores will be flooded.

90.4 wt% electrical conductor material ((50g Pt-C + 30% to 75% of (25g C/PTFE)) / (1g Nafion[®] + 50g Pt-C + 25g C/PTFE))).

Thus, while the claims require 10-50 wt % of a proton conductor material, none of the inventive examples of Uchida have a wt % of Nafion[®] that exceeds 2.0 wt %.

Uchida's comparative example is disclosed at col. 7, line 54 to col. 8, line 7. Uchida's comparative example does not explicitly disclose the amounts of the Pt-C component (10-25 wt% platinum) or of the C/PTFE component (25-70 wt% PTFE). Uchida discloses that the Pt-C and the C/PTFE are sprinkled on carbon paper and hot pressed to form an electrode. This hot pressed Pt-C with C/PTFE layer does not include a proton conductor material.

At the top of col. 8, in a new paragraph, Uchida discloses that a *coat* of Nafion[®] is applied to the previously hot-pressed catalyst layer of the electrode. In other words, in the comparative example, Uchida discloses that the Nafion[®] coat is a separate layer formed on the electrode after the electrode has been hot pressed. This separate Nafion[®] layer does not include any electrical conductor material.

Thus, with respect to the comparative example, Uchida fails to disclose any material having a proton-electron mixed conductive material. Rather, Uchida discloses two material layers: the hot pressed Pt-C with C/PTFE layer (and with no proton conductor material) and the Nafion[®] layer (with no electrical conductor material). These two distinct layers do not form a single proton-electron mixed conductive material as required by the claims of the instant application.

And, in fact, this is exactly the point of Uchida's comparative example—to compare the separate Nafion[®] and carbon layers of the comparative example to Uchida's inventive examples, which have a low level of Nafion[®] mixed in with the electrical conductor material. Given this, it is irrelevant what weight percent this separate Nafion[®] proton conductive layer has relative to the Pt-C with C/PTFE electron conductive layer.

Thus, neither Uchida's inventive examples (Examples 1-7) nor Uchida's comparative example disclose a proton-electron mixed conductive material having 10-50 wt % of a proton conductor material.

Vanderborgh is Not Relevant

Vanderborgh fails to disclose electrodes having the claimed composition, i.e., an electrical conducting material that is a proton-electron mixed conductive material having 10-50 wt % of a proton conductor material and 50-90 wt % of a first and a second electrical conductor material.

Vanderborgh discloses that an object of the invention is to provide a composite electrode which is constructed to have increasing electronic conductivity from the catalyst loading zone to a current collector on one face of the electrode, and to have increasing protonic conductivity from the zone of the catalyst loading to the face of the electrode which engages the ion exchange membrane. (Col. 3, lines 37-44).

Vanderborgh accomplishes this by providing an electrode comprised of three zones or layers. Referring to FIG. 2, Vanderborgh discloses that the composite electrode is formed of three separate layers (22, 24 and 26) thermally bonded to each other (col. 8, lines 13-15; col. 8, lines 59-62). Each layer comprises a mixture of carbon black, platinum, PTFE and a suitable ionic conducting material (col. 8, lines 16-20).

Table I discloses the compositional parameters for each layer. Layer 22 has a proton conducting material weight percent of 4.3% (.021/.491) and an electrical conducting material weight percent of 82.3% (.304/.491). Layer 24 has a proton conducting material weight percent of 4.4% (.119/2.718) and an electrical conducting material weight percent of 91.2% (2.48/2.718). Layer 26 has a proton conducting material weight percent of 74% (.422/.570) and an electrical conducting material weight percent of 12.1% (.069/.570). None of these layers has 10-50 wt % of a proton conductor material and 50-90 wt % of a first and a second electrical conductor material, as required by the claims.

Further, it would be improper to consider the entire composite electrode of Vanderborgh as a single electrical conducting material, i.e., to consider the three separate layers 22, 24, 26 to be a single material. Each separate layer of the electrode is a distinct material—bonding the layers together does not form a new “material.”

Grot Discloses Liquid Permeable Electrodes

In the example referred to by the Examiner, Grot discloses using a non-hydrophobic binder (Nafion®) for its fuel cell electrode (col. 14, lines 15-27). In addition

to the teachings of Surampudi, discussed above, (i.e., that the addition of Nafion[®] to an electrode composition creates a non-hydrophobic, liquid-fuel type electrode), Grot expressly discloses that the electrode is a “gas-*liquid* permeable porous electrode.” (Col. 1, lines 31-32; emphasis added.) Thus, Grot explicitly discloses that its electrode is a liquid-fuel type electrode, i.e., an electrode that is specifically designed to allow the penetration of the liquid into the pores of the electrode.

Grot further explicitly discloses that its membrane and electrode structure is useful in electrolytic cells where, for example, the anode electrolyzes an aqueous solution. Thus, again Grot discloses that the electrode is a liquid-fuel type electrode (col. 13, lines 35-50).

c. The Proposed Combination of References Changes Dempsey's Principle of Operation and, in fact, Renders Dempsey Unsatisfactory for its Intended Purpose

The Examiner has indicated that it would have been obvious to utilize the teachings of Uchida, Grot and/or Vanderborgh for the sensor of Dempsey. Applicants disagree.

As an initial matter, as discussed above, Uchida and Vanderborgh do not disclose the claimed electrode composition.

If one were to replace the hydrophobic electrodes, as expressly taught by Dempsey, with non-hydrophobic electrodes as disclosed by Grot, Dempsey's principle of operation would be changed. In fact, Dempsey would be rendered inoperable or, at the very least, unsatisfactory for its intended purpose due to flooding of the electrodes of Grot.

Dempsey teaches a gas sensor that uses a gas permeable (i.e. a gas-diffusion type) electrode. However, Dempsey also teaches surrounding the area of the counter electrode with distilled liquid water. Dempsey then further explicitly and repeatedly teaches using a hydrophobic binder for the electrodes. (Col. 8, lines 34-44.) Specifically, Niedrach (cited by Dempsey to disclose the electrodes used in the gas sensor of Dempsey and the process of making these electrodes) explicitly teaches using hydrophobic electrodes so that the electrodes will not “drown” in an aqueous environment (Niedrach, col. 1, lines 19-30). In essence, Dempsey teaches away from using a non-hydrophobic binder for the electrodes.

Grot discloses including a non-hydrophobic binder (Nafion[®]) in its fuel cell electrodes.

Surampudi teaches that the inclusion of Nafion® in the electrode composition converts a gas-diffusion type electrode into a liquid-fuel type electrode, i.e., a non-wetting electrode is converted into a wetting-type electrode.

A person of ordinary skill the art would realize that replacing Dempsey's gas-diffusion type, hydrophobic electrodes with liquid-fuel type electrodes as taught by Grot would result in the electrodes being flooded/drowned with Dempsey's distilled water, such that the gas to be reacted would be unable to reach the reaction sites within the electrodes. (See discussion of Surampudi, above.) Simply put, the electrodes would be flooded and Dempsey's gas sensor would be unable to sense or react to the gas. Thus, contrary to the Examiner's assertion, as the combination renders Dempsey's sensor inoperable, one of ordinary skill in the art would have reason to NOT replace the hydrophobic electrodes of Dempsey with the non-hydrophobic electrodes of Grot.

i. Claims 79, 81, 86, 88 and 97

Claims 79, 81, 86, 88 and 97 stand rejected over Dempsey et al. (US 4,277,984) in view of Nagata et al. (US 4,913,792) and any of Vanderborgh et al. (US 4,804,592), Uchida et al. (US 5,474,857) and/or Grot et al. (US 5,330,860). Applicants traverse these rejections as follows.

As an initial matter, as discussed above, Dempsey teaches away from using an electrode as taught by Grot (and Uchida and Vanderborgh are not relevant). Further, there is no reasonable expectation of success for the combination of Grot with Dempsey. And, in fact, Applicants have shown above that combining Grot with Dempsey would render Dempsey inoperable. Nagata fails to cure these deficiencies.

Nagata discloses three-electrode gas sensors. Nagata further discloses that for certain configurations of three-electrode sensors, operating under certain conditions and accompanied by specific modifications to the electrodes, the reference electrode of a three-electrode sensor can be eliminated. The Examiner relies upon the disclosure of Nagata to assert that gas sensors in general may be readily transferable between a three-electrode gas sensor and a two-electrode gas sensor (OA, pp. 6-7). Applicants disagree and submit that the Examiner is improperly applying the teachings of Nagata to Dempsey.

Dempsey's principle of operation would be completely changed should it be converted from a three-electrode sensor to a two-electrode sensor, i.e., should its third electrode (the reference electrode) be eliminated. The entire focus of Dempsey's disclosure is the interaction of the reference electrode with the sensing electrode such that Dempsey's potentiostated, three-electrode sensor will have highly invariant background current characteristics with temperature during zero-air operation (see Title). Without a reference electrode, Dempsey would no longer be a potentiostated sensor. The Examiner recognizes this and indicates that obviating the need for a potentiostated sensor simplifies the circuitry and is therefore an advantage. While this may or may not be true (note that the contemporaneously filed application, S/N 773,136 to LaConti (sic, Nolan) referred to in Dempsey indicated that the potentiostated, three-electrode sensor solved certain problems associated with non-potentiostated, two-electrode sensors), the point is that *Dempsey's entire principle of operation is based on the sensor being a potentiostated sensor having a reference electrode*. For example, Dempsey teaches that, although the cell output current may be temperature compensated to cancel errors due to changes in temperature (see Fig. 3 and col. 9, lines 37-62), Dempsey's use of the reference electrode eliminated the need for temperature compensation under "zero-air" conditions. This use of the reference electrode is a key feature of Dempsey's principle of operation. As another example, should Dempsey no longer have a reference electrode, it would no longer have a use for a swollen, hydrated, ionically conductive bridge between the sensing and reference electrode. Yet, this bridge is a key feature of Dempsey's principle of operation. In short, to even consider Dempsey without a reference electrode is meaningless, as the reference electrode is central to Dempsey's structure and operation.

Further, the three-electrode sensor of Dempsey differs significantly from the three-electrode sensor of Nagata, and thus, one would not consider applying the teachings of Nagata's three-electrode sensor to the three-electrode sensor of Dempsey. Even further, because of the significant differences between the three-electrode sensors of Dempsey and the three-electrode sensors of Nagata, Nagata's teaching that two-electrode sensors may be utilized in place of three-electrode sensors is not applicable to the sensors of Dempsey.

Some of the significant differences between the three-electrode sensors of Dempsey and Nagata include:

- Dempsey's sensing electrode is maintained at a fixed potential above the reference electrode to produce rapid oxidation of the gaseous constituent to be detected and above the rest potential of the electrode in the uncontaminated atmosphere (col. 2, lines 40-48); Nagata's working electrode is maintained at a set potential from the counter electrode (col. 3, lines 13-27).
- Dempsey's thermal, chemical and electrical characteristics for its sensing and reference electrodes are as similar as possible (col. 4, lines 11-21); Nagata's working electrode is a Pt electrode and its reference electrode is an Ag electrode (col. 5, lines 11-17).
- Dempsey's reference electrode is exposed to the uncontaminated atmosphere, i.e., to the atmosphere without the gaseous constituent being measured; Nagata's reference electrode is exposed to the same constituents as the working and counter electrodes.
- Dempsey's sensing electrode is the only electrode exposed to the gas constituent being measured (see Fig. 1); Nagata's working, counter and reference electrodes are all exposed to the gas constituent being measure (see Figs. 1 and 2, gas-permeable film 5).
- Dempsey discloses a hydrated gas sensor for operation from 1°C to 40°C; Nagata discloses a flammable gas sensor for operation from 100°C to 400°C.

Thus, it can be seen that Dempsey's reference electrode performs a completely different function than that of Nagata's reference electrode. Dempsey's reference electrode, which is as similar as possible to the sensing electrode and positioned as close as possible to the sensing electrode, and which is exposed to the atmosphere without the contaminating gas, is used, at least in part, to provide temperature stability during "zero-air" operation. In contrast, Nagata's reference electrode, which is not similar to the working electrode and which is exposed to the same contaminated atmosphere as the working electrode, is not used to provide temperature stability during "zero-air" operation. As the three-electrode sensor of Nagata so significantly differs in its construction and operation from the three-

electrode sensor of Dempsey, there is no predictability or reasonable expectation of success that Nagata's teachings concerning three- and two-electrode sensors could be applied to Dempsey's three-electrode sensor.

As to the Examiner's contention that Dempsey's reference electrode is the source of the temperature variation problem, Applicants disagree and maintain their arguments as presented above and in the previously filed responses. Further, Applicants submit that there is no disclosure in Dempsey that the reference electrode is the source of the "background current" that Dempsey want to eliminate—rather, it appears that the effect of temperature variation on the sensing electrode relative to the counter electrode causes the undesirable background current.

As the Examiner has recognized that Dempsey fails to disclose that the sensing electrode and the counter electrode are the only two electrodes, and as Nagata, as discussed above, fails to disclose that the reference electrode of Dempsey could be eliminated without disrupting the principle of operation of Dempsey, the combination of Dempsey in view of Nagata fails to render claims 79, 81, 86, 88 and 97 unpatentable. Further, as none of Vanderborgh, Uchida or Grot discloses two-electrode sensors, Vanderborgh, Uchida and Grot fail to cure the deficiency of Dempsey in view of Nagata.

Claims 81 and 88

Claim 81 and 88 additionally recite that the sensing electrode reacts with the gas to produce a change in electrical characteristic between the sensing electrode and the counter electrode "*in the absence of an applied voltage to the sensing electrode.*" Dempsey particularly discloses that the sensing electrode is maintained at a potential (col. 2, lines 40-62). Nagata also discloses that the working electrode has an applied voltage (see item 9 in Fig. 8 and col. 7, line 66 – col. 8, line 5). Thus, the combination of Dempsey in view of Nagata and Vanderborgh, Uchida or Grot fails to disclose the "absence of an applied voltage to the sensing electrode."

Claim 97

Claim 97 additionally recites that the sensing and the counter electrodes are approximately 15 mm in diameter. Nagata discloses that the two-electrode sensor is only feasible if the "counter electrode is larger in area than the working electrode by a factor of a

two-figure number or more” In other words, Nagata expressly teaches away from the interchangeability of three-electrodes and two-electrodes when the electrode areas are of the same order of magnitude. Thus, the combination of Dempsey in view of Nagata and Vanderborgh, Uchida or Grot fails to disclose each and every element of this claim.

For all the above reasons, the subject claims are patentable over the applied citations.

ii. Claims 79-101, 103-106 and 108-113

Claims 79-101, 103-106 and 108-113 stand rejected over Tomantschger et al. (US 5,173,166) in view of Dempsey and any of Vanderborgh, Uchida and/or Grot. Applicants traverse these rejections as follows.

The Examiner has also recognized that Dempsey fails to disclose a porous mixed ionic-electronic conductive sensing electrode and/or a porous mixed ionic-electronic conductive counter electrode. As an initial matter, as discussed above, Uchida and Vanderborgh do not disclose the claimed electrode composition; Dempsey teaches away from using a non-hydrophobic electrode as taught by Grot; and combining Grot with Dempsey would render Dempsey inoperable. Tomantschger ‘166 fails to cure these deficiencies.

In fact, the Examiner has recognized that Tomantschger ‘166 fails to disclose a porous mixed ionic-electronic conductive sensing electrode and/or a porous mixed ionic-electronic conductive counter electrode. However, the Examiner has indicated that it would be obvious to use the teachings of Grot (or Vanderborgh and/or Uchida) for the electrodes of Tomantschger ‘166. Applicants disagree.

It is improper to attempt to replace Tomantschger’s hydrophobic electrodes with the non-hydrophobic electrodes of Grot:

Applicants submit that it is improper to attempt to combine Tomantschger ‘166 with Grot (as discussed above, Uchida and Vanderborgh are not relevant). Specifically, Grot discloses a non-hydrophobic electrode (see Surampudi and discussion above), while Tomantschger ‘166 repeatedly and expressly teaches the use of hydrophobic electrodes. Tomantschger, in essence, teaches away from using non-hydrophobic electrodes.

Tomantschger '166 teaches away from using non-hydrophobic electrodes because Tomantschger is concerned with preventing electrolyte leakage, and non-hydrophobic electrodes would allow the electrolyte to leak. For example, in the Background section, Tomantschger '166 discusses the problem of electrolyte leakage and the failings of the prior art:

“LaCONTI 4,025,412 ... the structure is susceptible to electrolyte leakage.”
(Col. 3, lines 7-14.)

“KITZELMANN et al, 4,394,239 ... however such metals are hydrophilic, which may result in electrolyte loss.” (Col. 3, lines 31-32.)

Tomantschger '166 solves this problem of electrolyte leakage, at least in part, by using hydrophobic electrodes, i.e., electrodes that preclude electrolyte loss. For example, with respect to its inventive electrodes, Tomantschger '166 discloses:

“The porous electrode may comprise a porous base layer, a catalytically active metal ..., carbon, and a *polymeric hydrophobic binder*.”

(Abstract, emphasis added.)

“Still further, the present invention provides porous electrodes which may comprise at least one porous layer containing a catalytically active metal—usually a noble metal—carbon, and a *polymeric hydrophobic binder*.”

(Col. 5, lines 23-27, emphasis added.)

“The catalyst may be a catalytically active noble metal ... *all with a suitable polymeric hydrophobic binder*.”

(Col. 6, lines 28-33, emphasis added.)

“The porous electrodes having a PTFE structure with carbon are particularly useful in the present invention. ... At the same time, because of the *hydrophobicity of the PTFE, electrolyte leakage is precluded*.”

(Col. 10, lines 36-43, emphasis added.)

“[C]arbon filled gas permeable paper or cloth may be dipped into PTFE Then the components of the electrochemical cell are place in an assembly jig In that instance, the conductive plastic plates heat up and melt into the two electrode structures, *producing a conductive and liquid tight bond*.”

(Col. 10, lines 54-62, emphasis added.)

“In keeping with the invention, the porous sensing electrodes used in the electrochemical sensing cells discussed above comprise a layer which

contains a catalytically active metal—usually a noble metal—together with carbon and a *polymeric hydrophobic binder*, all in a suitable substrate.”

(Col. 11, lines 26-31, emphasis added.)

“The polymeric binder may be any suitable inert resin, *particularly a hydrophobic component*. Examples of such binders include polyethylene, polypropylene, polyvinylchloride, polystyrene, and PTFE”

(Col. 11, lines 26-53, emphasis added.)

Thus, Tomantschger ‘166 repeatedly and expressly teaches that its electrodes are formed with a polymeric binder that is hydrophobic so as to preclude leakage of the electrolyte. In fact, each of the five examples of the composition of typical electrodes in the table of column 12 include a backing layer with 50% PTFE (a hydrophobic polymeric binder) and an active layer with from 11% to 50% PTFE.

Even further, Tomantschger ‘166 teaches away from using non-hydrophobic electrodes because Tomantschger discloses gas sensing electrodes, i.e. gas permeable electrodes, in contact with liquid electrolyte. Were the gas sensing electrodes of Tomantschger ‘166 to be non-hydrophobic, the electrodes would be flooded by the liquid electrolyte and would thereby be rendered inoperative. In other words, Tomantschger ‘166 is only operative if the gas sensing electrodes are hydrophobic, such that flooding of the electrodes by the liquid electrolyte is prevented.

Thus, Applicants submit that it is improper for the Examiner to conclude that the non-hydrophobic electrodes of Grot could be simply substituted into the sensor of Tomantschger ‘166. First, the use of the non-hydrophobic electrodes as taught by Grot is at odds with the express teachings of Tomantschger ‘166 regarding its use of hydrophobic electrodes to preclude electrolyte leakage. Further, the use of the non-hydrophobic electrodes as taught by Grot in the sensor of Tomantschger ‘166 would render Tomantschger’s sensor inoperative due to flooding of the electrodes by the liquid electrolyte.

It is improper to assume that Dempsey’s electrode and membrane dimensions are applicable to Tomantschger’s sensor:

As recognized by the Examiner, Tomantschger ‘166 does not explicitly disclose a particular diameter for its electrodes or a particular thickness of protonic conductive

electrolyte membrane. The Examiner relies on Dempsey for its disclosure of sensing and counter electrodes having a diameter of 16 mm and a Nafion® membrane thickness of .3 mm. The Examiner asserts that it would have been obvious to use the electrode and electrolyte (sic, membrane) dimensions of Dempsey for the dimensions of Tomantschger '166. Applicants disagree.

The absence of any disclosure in Tomantschger '166 as to electrode diameters or membrane thicknesses, does not lead one to conclude that *any* dimensions could be utilized. This is particularly the case when considering the claims directed to two-electrode electrochemical gas sensors. In fact, Nagata, cited by the Examiner and discussed above, explicitly discloses that the dimension of a counter electrode for a three-electrode sensor (e.g., Nagata, FIG. 1) is different than the dimension of a counter electrode for a two-electrode sensor (Nagata, FIG. 8).

For example, Nagata discloses that when a reference electrode is eliminated from a three-electrode sensor, for certain functionalities and under certain operating conditions, commensurate performance of the three-electrode sensor may be achieved if the area of the counter electrode in the two-electrode sensor is ten or more times (and preferably 100 times) as large as the sensing electrode.

Thus, at the very least, Nagata teaches that Dempsey's disclosure as to dimensions of components of a three-electrode sensor does not provide any teachings, and is thus irrelevant, as to any dimensions of components of a two-electrode sensor, such as disclosed by Tomantschger '166.

As it is improper to combine Tomantschger '166 with Vanderborgh, Uchida or Grot, with respect to the composition of the electrodes, and as it is further improper to combine Tomantschger '166 with Dempsey with respect to the dimensions of the sensor components, claims 79-101, 103-106 and 108-113 are not rendered unpatentable over the asserted combination of references.

iii. Claims 80, 82, 84, 87, 89, 91, 92, 95, 96, 98-101, 103, 104 and 108-113

Claims 80, 82, 84, 87, 89, 91, 92, 95, 96, 98-101, 103, 104 and 108-113 stand rejected over Dempsey in view of any of Vanderborgh, Uchida and/or Grot.

As presented above (see *infra* pp.41-42), Applicants submit that a person of ordinary skill in the art would realize that replacing Dempsey's gas-diffusion type, hydrophobic electrodes with a liquid-fuel type electrode as taught by Grot (Uchida and Vanderborgh not being relevant) would result in the electrodes being flooded/drowned with the distilled water, such that the gas to be reacted would be unable to reach the reaction sites within the electrodes. (See discussion of Surampudi, above.) In essence, the electrodes would be flooded and Dempsey's gas sensor would be unable to sense or react to the gas. Thus, contrary to the Examiner's assertion, as the combination renders Dempsey's sensor inoperable, one of ordinary skill in the art would have reason to NOT replace the hydrophobic electrodes of Dempsey with the non-hydrophobic electrodes of Grot.

Further, claim 80 includes the recitation of "the sensing electrode reacting with the gas to produce a change in an electrical characteristic between the sensing electrode and the counter electrode in the absence of an applied voltage to the sensing electrode." Claims 84, 87, 91 and 94 include similar recitations. Claim 92 recites "in the absence of any biasing voltage."

The Examiner has indicated that the electrode of Dempsey in view of Vanderborgh, Uchida and/or Grot would inherently be capable of reacting with a gas in the absence of an applied voltage to the sensing electrode. Applicants traverse these rejections as follows.

A finding of inherency requires that the missing descriptive matter is necessarily present. Inherency may not be established by probabilities or possibilities. The mere fact that a certain thing may result is not sufficient. MPEP 2112(IV). Further, in relying upon the theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the prior art. *Id.* Applicants submit that the Examiner has not provided such a basis. Nor is any reason apparent to Applicant as to why Dempsey in view of the secondary citations could necessarily be capable of reacting with a gas in the absence of an applied charge to the sensing electrode. Furthermore, as to obviousness, obviousness cannot be predicated on what is not known at the time the invention was made, even if the inherency of a certain feature is later established. MPEP 2141.02(V).

Indeed, Dempsey expressly teaches that “the voltage [of the sensing electrode] should not be allowed to fall below approximately 1.0 volts in order to maintain an oxide coating on the surface of the catalytic sensing electrode to prevent CO poisoning of the electrode and to prevent reduction of oxygen at the electrode or other competing reactions which introduce error currents.” Col. 10, lines 3-9. In other words, *Dempsey expressly teaches that its sensor electrode would be poisoned by CO in the absence of a maintained voltage of 1.0 or greater.* In light of this express teaching and in the absence of any teaching as to why the electrodes of Grot (Uchida and Vanderborgh not being relevant) would not be poisoned by CO, it appears that the electrode of Dempsey in view of Grot would not inherently be capable of reacting with a gas in the absence of an applied voltage to the sensing electrode.

Accordingly, Applicants submit that claims 80, 84, 87, 91, 92, 95, 96, 98-101, 103, 104 and 108-113 are not rendered unpatentable over the asserted combination of references.

Claims 82 and 89 further include the recitation that “the sensing electrode and the counter electrode [are] on opposite sides of the first protonic conductive electrolyte member.” For at least the reason that the combination of Grot with Dempsey would render Dempsey’s sensor inoperable, such that one of ordinary skill in the art would have reason to NOT replace the hydrophobic electrodes of Dempsey with the non-hydrophobic electrodes of Grot, Applicants submit that claims 82 and 89 are also allowable. Claims 98-113 and amended claims 2, 17, 18 and 27 depend directly or indirectly from claim 82 and contain additional recitations thereto. Thus, Applicants respectfully submit that these claims are also patentably distinguishable from the cited references.

iv. Claims 83, 85, 90, 93 and 94

Claims 83, 85, 90, 93 and 94 stand rejected over Dempsey in view of any of Vanderborgh, Uchida and/or Grot and further in view of Nagata.

As an initial matter, as discussed above, Dempsey teaches away from using an electrode as taught by Grot (or Uchida, or Vanderborgh), and further combining Grot (or

Uchida, or Vanderborgh) with Dempsey would render Dempsey inoperable. Nagata fails to cure these deficiencies

The Examiner has asserted that it would have been obvious to utilize only two electrodes for the sensor of Dempsey as taught by Nagata. Applicants disagree, and as presented above, have shown that the teachings of Nagata concerning any substitution of a two-electrode sensor for a three-electrode sensor are not applicable to the three-electrode temperature-stabilized sensor of Dempsey.

Accordingly, Applicants submit that claims 83, 85, 90, 93 and 94 are not rendered unpatentable over the asserted combination of references.

v. *Claim 102*

Claim 102 stands rejected over Dempsey in view of any of Vanderborgh, Uchida and/or Grot and further in view of Tomantschger '274 (US 5,302,274). Alternatively, claim 107 stands rejected over Tomantschger '166 in view of any of Vanderborgh, Uchida and/or Grot and further in view of Tomantschger '274.

As an initial matter, as discussed above, Dempsey teaches away from using an electrode as taught by Grot (Uchida and Vanderborgh being irrelevant), and further combining Grot with Dempsey would render Dempsey inoperable. Additionally, Tomantschger '166 also teaches away from using a non-hydrophobic electrode as taught by Grot. Tomantschger '274 fails to cure these deficiencies.

Accordingly, Applicants submit that claim 102 is not rendered unpatentable over the asserted combinations of references.

vi. *Claims 105 and 106*

Claims 105 and 106 stand rejected over Dempsey in view of any of Vanderborgh, Uchida and/or Grot and further in view of LaConti (US 4,820,386).

As an initial matter, as discussed above, Dempsey teaches away from using an electrode as taught by Grot (Uchida and Vanderborgh being irrelevant), and further combining Grot with Dempsey would render Dempsey inoperable. LaConti fails to cure these deficiencies.

Accordingly, Applicants submit that claims 105 and 106 are not rendered unpatentable over the asserted combination of references.

vii. Claim 107

Claim 107 stands rejected over Dempsey in view of any of Vanderborgh, Uchida and/or Grot and further in view of Razaq (US 5,322,602). Alternatively, claim 107 stands rejected over Tomantschger '166 in view of any of Vanderborgh, Uchida and/or Grot and further in view of Razaq.

As an initial matter, as discussed above, Dempsey teaches away from using an electrode as taught by Grot (Uchida and Vanderborgh being irrelevant), and further combining Grot with Dempsey would render Dempsey inoperable. Additionally, Tomantschger '166 also teaches away from using an electrode as taught by Grot. Razaq fails to cure these deficiencies.

Accordingly, Applicants submit that claim 107 is not rendered unpatentable over the asserted combinations of references.

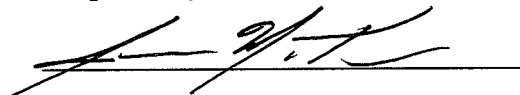
VI. Conclusion

Each of claims presented herein is directed to subject matter that was originally disclosed but never claimed. Applicants respectfully request consideration of all the claims.

If any fees are required for entry of this response, the Director is authorized to debit Deposit Account No. 19-0733, accordingly.

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Respectfully submitted,



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